

## **Understanding Mine Heat – M.A.Sc. Thesis – Michelle Levesque**

In recent years, climate change has been identified as a major environmental concern. Climate change is directly linked to energy consumption by the emission of greenhouse gases; therefore reducing energy demand can have a positive impact with respect to global warming. Mining companies consume large quantities of energy and one way to diminish their energy consumption is by reducing wasted energy. There are several types of energy, however this study will focus on reducing wasted thermal energy which may originate from a thermal or electrical energy source.

The first step in reducing wasted energy involves an analysis of the various processes involved in the mining industry such as ventilation, beneficiation and smelting. JKSimMet is a software package which allows the simulation and analysis of mineral processes such as comminution and classification in order to measure plant performance or evaluate design alternatives. In addition, VUMA which stands for Ventilation of Underground Mine Atmospheres, will be used to model mine ventilation, cooling and environment control. The use of simulation software such as JKSimMet and VUMA will facilitate the task of characterizing waste heat. Once potential thermal energy sources are identified, they must be quantified. Additionally, the quality or grade of the waste heat must be assessed.

Subsequently, thermal energy demand profiles will be examined in order to identify processes which require heat input. Thermal energy demand can fluctuate throughout the course of a day due to production cycles as well as the variation between daytime and night-time temperature. Additionally, the change in seasonal temperatures will also produce variations with respect to thermal energy demand therefore diurnal and seasonal profiles will be established.

Once the thermal energy sources and demand areas have been characterized (quantity and quality), the process of establishing a link between the two can be carried out. Currently, heat generated as a by-product during the various mineral processing stages is released to the atmosphere. However, transporting this otherwise wasted heat to supply other areas in the process will have a positive impact on the company's energy consumption.

Additionally, a review of advancements in heat transport and storage technology will identify efficient methods which can be implemented in the mining industry. An economic evaluation of recycling heat in the mineral processing industry will also be performed in order to assess the feasibility of implementing such technology.

This project will focus on quantifying and qualifying waste heat from various processes within the mineral processing industry and identify processes where this energy can be redirected and utilized. By achieving this, mining companies will benefit from the reduced energy consumption with increased profits while promoting sustainable mining and meeting stringent environmental regulations. Hopefully, the study will raise awareness for improved planning and energy management in the plant's design stage.